



# European feed-in tariffs without RPS programs

Best practices and lessons learned

Hans Cleijne

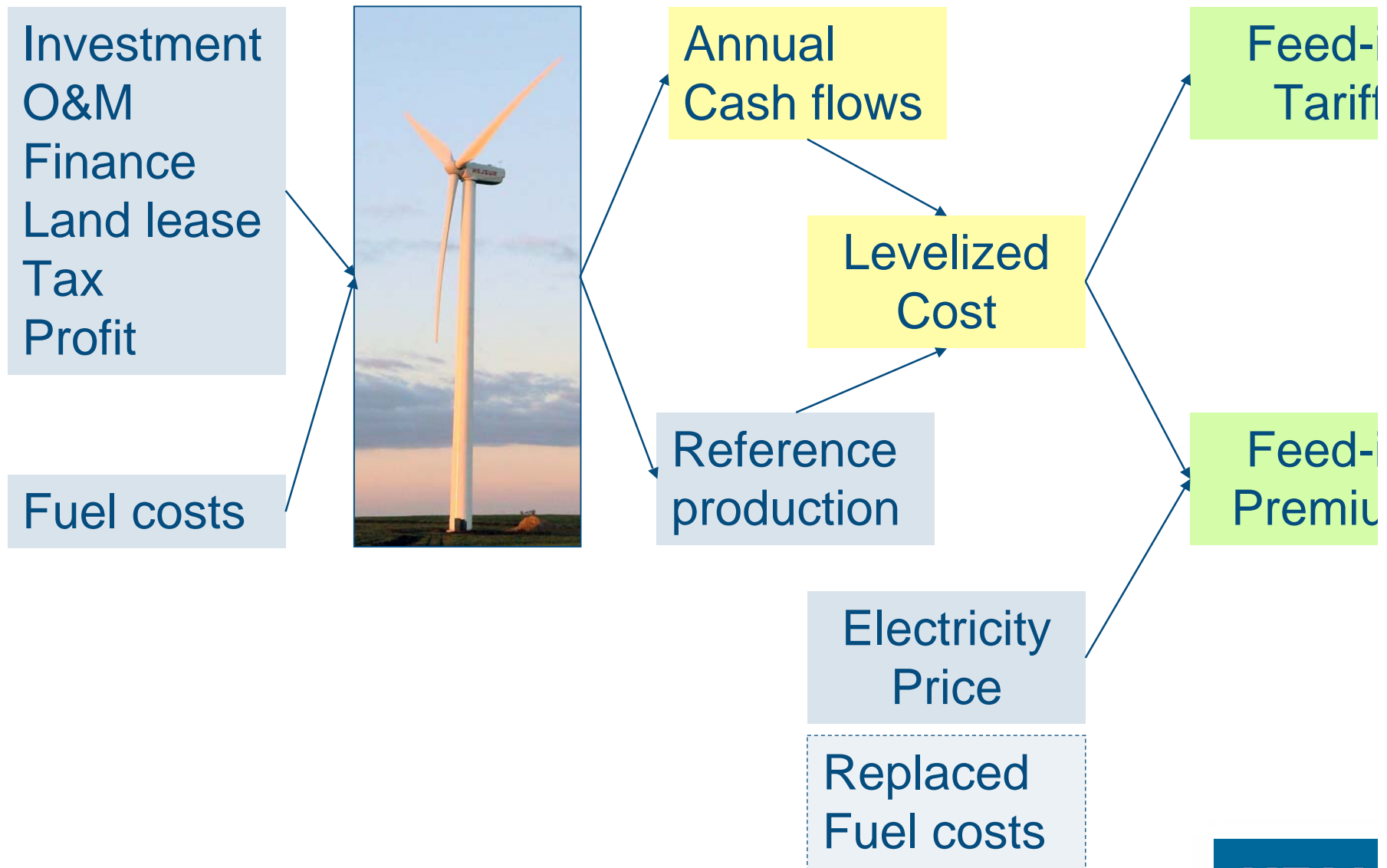
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# What do we do?

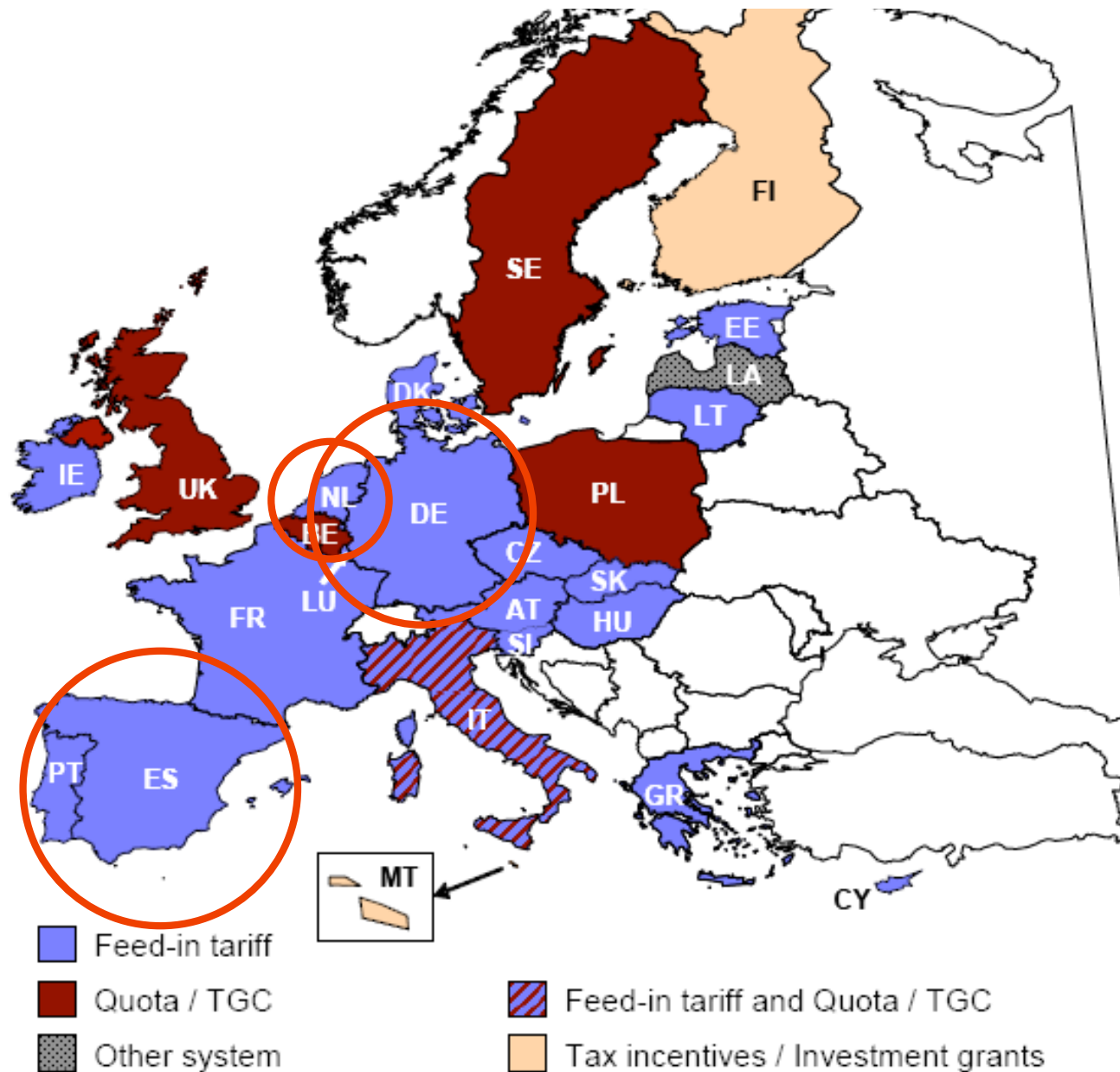


- ECN and KEMA assigned by Dutch government
  - to determine feed-in premiums
  - help with system design
- Participated in European studies on harmonization Renewable Electricity (RES-E) Support System

# What is a feed-in tariff?



# Support systems in Europe



# Differentiated tariff for different optio

- Biomass
  - Standalone – co-fired
  - Various fuels
- Solar
- Hydro
- Wave & Tidal
- Waste incineration
- Wind energy
  - Offshore – onshore

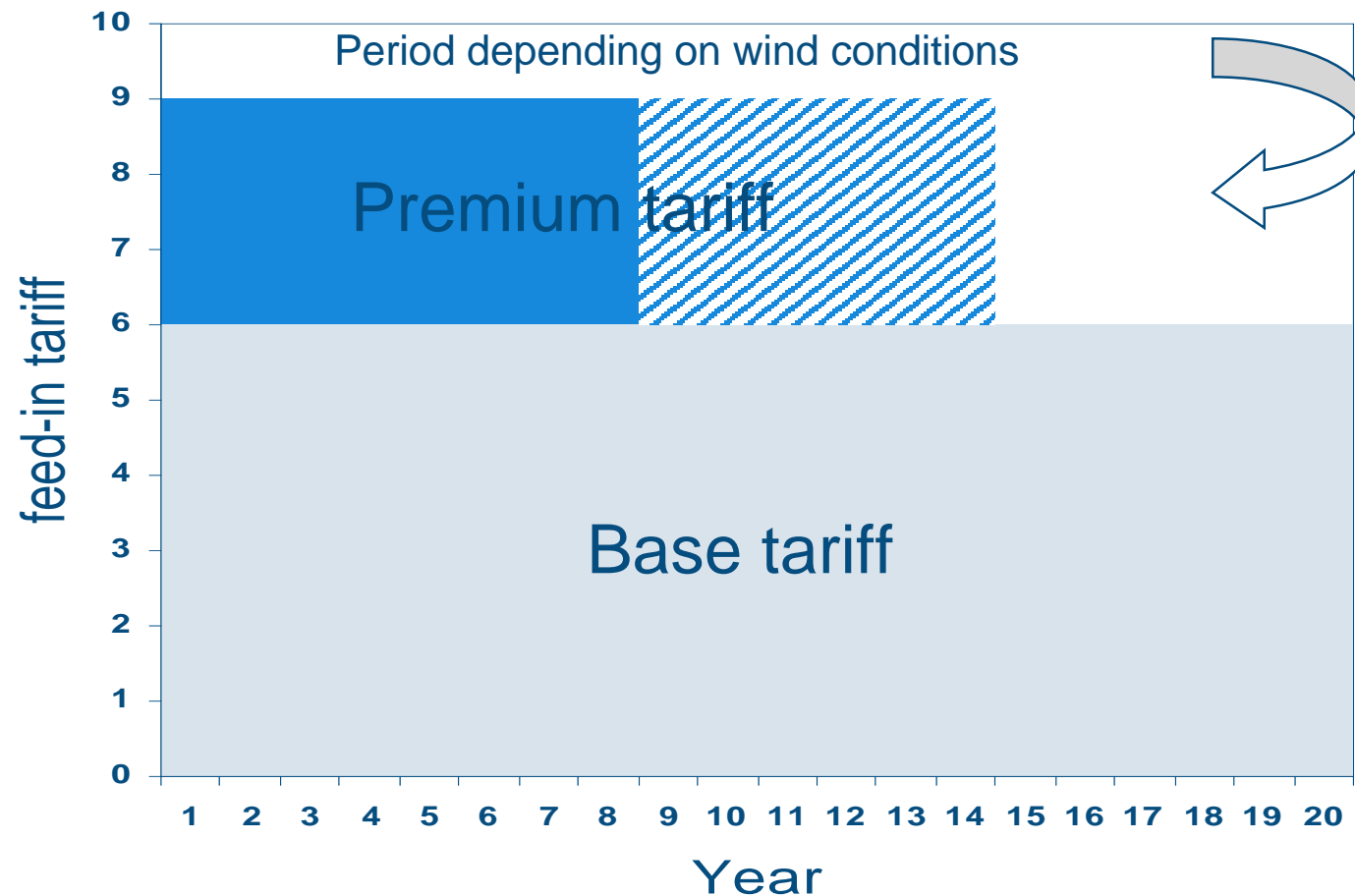


# Different categories

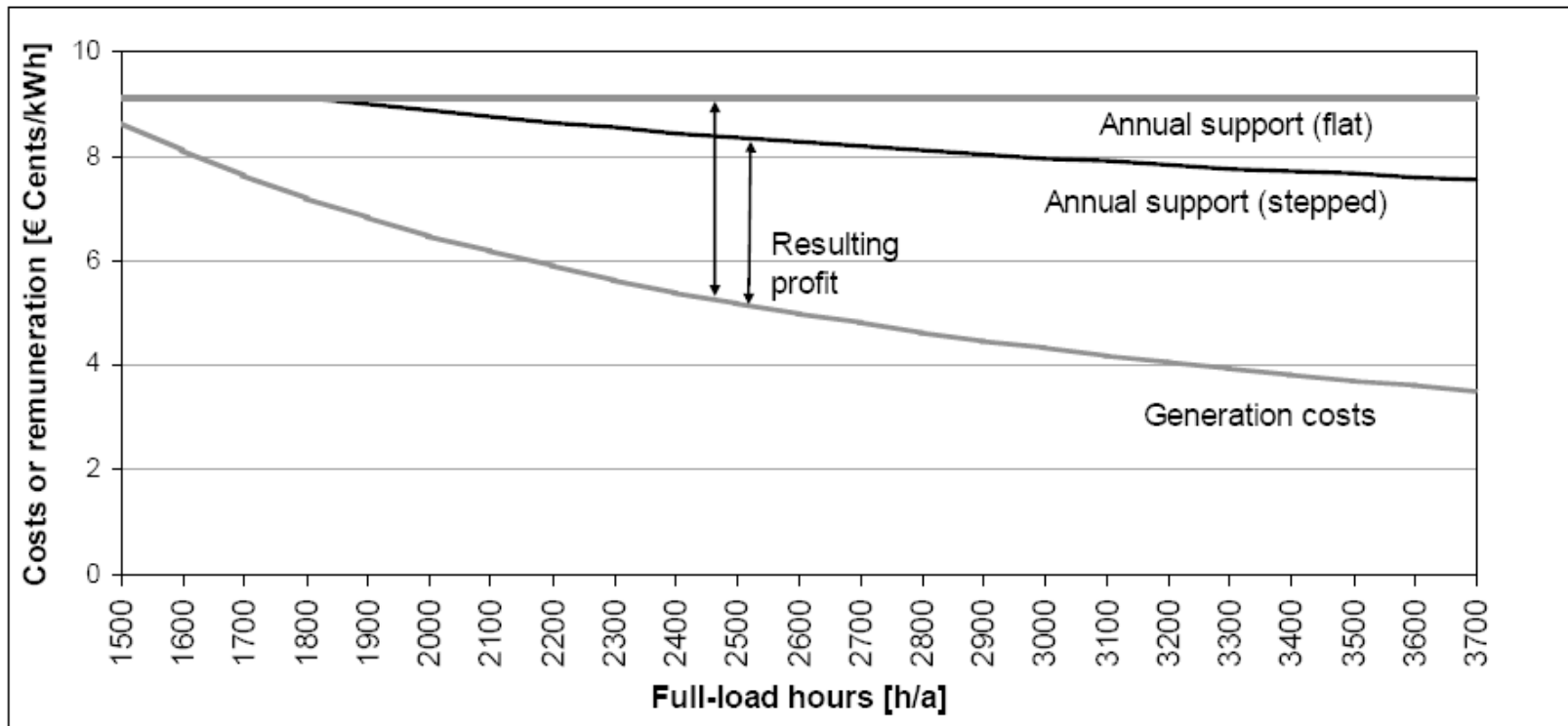
- Similar options are collected in separate categories which generic feed-in tariffs or premiums are set
  - Technology
  - Fuel
- Questions:
  - How many categories are acceptable/necessary?
  - Reference projects available?
  - How to handle emerging categories
  - How to stimulate new technology

# Stepped feed-in tariffs

Example: wind energy



# Resulting support level





# Lessons learned: stepped tariffs

## Advantage

- Local conditions, plant size or fuel type can be taken into account
- Not only the sites with most favorable conditions can be exploited
- Producer profit is kept low at favorable sites. Burden on electricity consumer is lower.

## Disadvantage

- The system can lead to high administrative complexity (e.g. for defining a reference turbine as in Germany).
- Many different tariff levels may lead to less transparency and uncertainty for the investors.
- May induce strategic behavior: large generators on wind turbines, dividing plants into smaller units leading to inefficient generation

# Germany



- EU target 12.5% RES-E in 2010, 20% in 2020
- 10% RES-E in 2005
  - 35% hydro, 45% wind power, 14% biomass and 6 solar
  - Strong development in wind power (20 GW in 2003, 30% of global capacity)
  - High ambitions for solar (6 GW)
- Present feed-in tariff based on Renewable Energy L (2004)
  - 20 year support
  - Wind energy stepped feed-in tariff

# Germany - evaluation



- Very successful in development of RES-E
- Long term subsidy gives confidence to investors and banks leading to lower risk premiums
- Published digression factor leads to decreasing cost
- Transmission System Operators (TSO) are obliged to absorb RES-E power
  - RES-E separated from the power market
  - Wind energy development mainly in the North leads to uneven distribution of burden
  - Solved by distributing wind profile over the country
  - As a consequence physical power transports arise leading to conflicts with trading parties

# Germany



## Lessons

- Feed-in tariff very successful in starting market
- In the long run integration with the power market will be necessary
- Regulation may have an effect on the functioning of electricity system
- Stakeholders are reviewing the possibility of a Feed-in premium, coupled to a power market index

# Spain



- EU target 29.4% RES-E in 2010
- 15% RES-E in 2005
  - 45% hydro, 40% wind power, 15% biomass
- Strong development in wind power (12 GW), potential for 20 GW
- Present feed-in system based on Electricity bill 1997
- Generators can choose between two options each year
  - Feed in tariff
  - Feed in premium  
(90% of wind farmer owners have switched to this option)

# Spain - basis Average Electricity Tariff (AET)



Subsidy for lifetime of plant  
No stepped feed-in tariffs

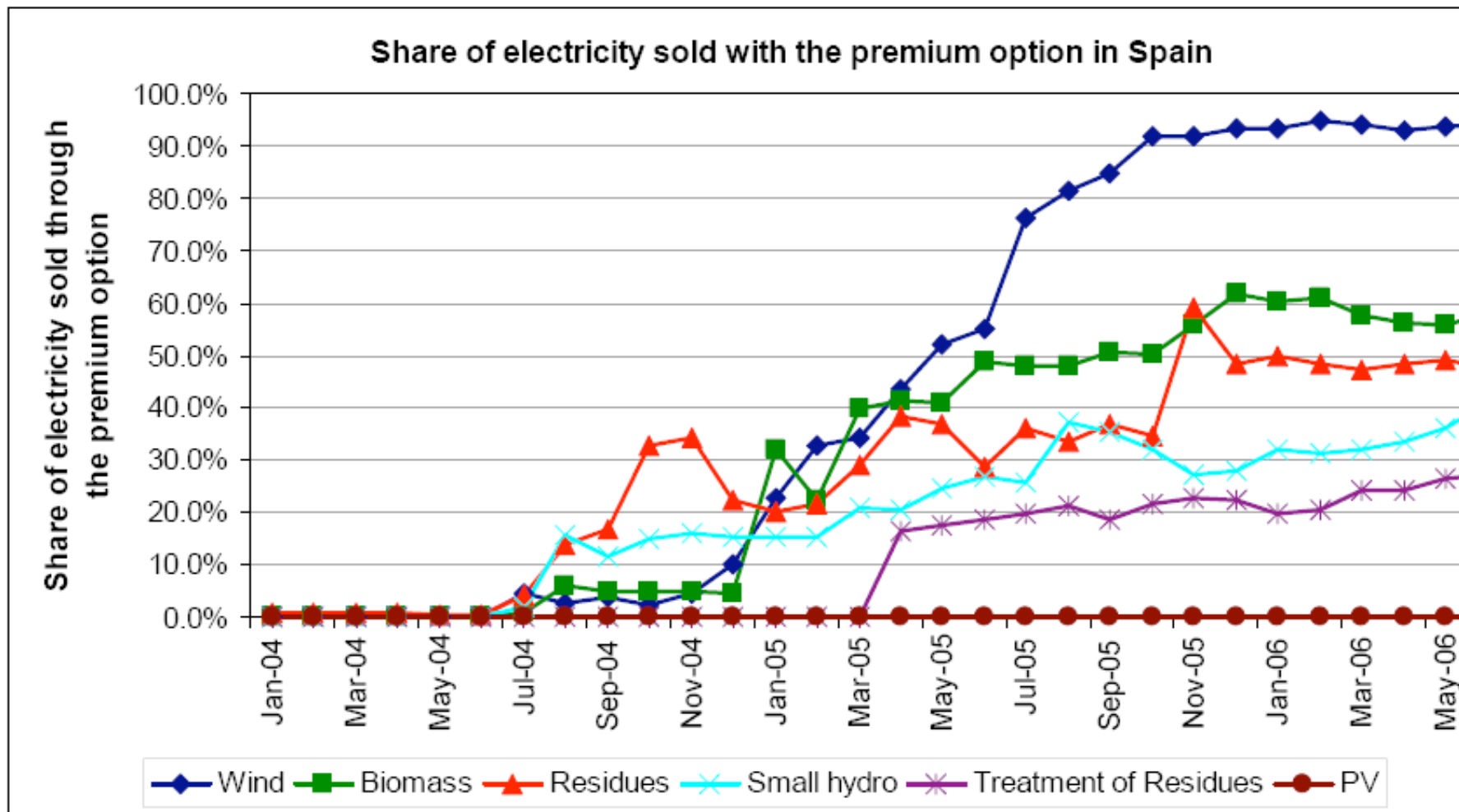
## Fixed tariff

- 80-90% of AET for wind and biomass
- Up to 575% for solar
- Fee for reactive power
- Fee for security of supply

## Premium tariff

- 30-40% of AET for wind and biomass
- Market participation incentive (10% of AET)
- Capacity credit
- Fee for reactive power
- Fee for security of supply

# Spain - 95% of wind farm owners have switched



# Spain - Evaluation



- Very successful in stimulating new developments
- Feed-in premium coupled to AET
  - allowed to increase by maximum 2%
  - Prices in the spot market much higher
  - Overstimulation
- Government has decided to change the system
  - AET raise is not limited anymore leading to more fluctuations and lower tariffs
- Lesson:
  - Feed-in premium should use the correct reference the electricity price



# Netherlands



- EU target 9% RES-E in 2010
- 60% biomass (mainly co-firing), 30% wind power
- Present feed-in premium system based on Electricity bill 1998
- Maximum tariff 10 cents/kWh
- Feed-in premium based on generation costs minus expected long term estimate of long term electricity price
- Electricity is sold to electricity utilities, charged for imbalance

# Netherlands - evaluation



- 2010 targets will be reached
- In 2006 tariffs were set to zero
  - Too many applicants, open ended scheme
  - Funding was part of government budget (“general fund”). Possibilities to deal with overspending were too limited
  - Palm oil in gas fired stations entered the market unexpectedly
- RES-E generators were over-subsidized due to increased electricity prices and changed electricity contracts
- New law in preparation

# Netherlands – new subsidy scheme



- Budget will be limited and coupled to target for RES
- Budget may be moved from “general fund”
- Premium will become dependent on spot market price for electricity
  - Risk for over-subsidizing is decreased
  - Fluctuating premium means fluctuating government allocation
- Modification of stepped feed-in tariff

# Best practices and recommendation

- Authorities should state long term targets and reserve sufficient budgets in order to give confidence to the market
- Technology specific tariff levels limit costs and over-subsidizing. Stepped feed-in tariffs may be used to vary subsidies within a single technology
- Premium systems are very sensitive to variations in electricity price. A suitable reference price is a must.
- Interaction with the electricity system should be studied carefully
- Learning effects can be induced by decreasing tariff gradually



End sheet

Thank you for your attention.